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CALIFORNIA STATE MINING BUREAU
FERRY BUILDING, SAN FRANCISCO

ETCHER HAMILTON, State Mineralogist

San Francisco] PRELIMINARY REPORT No. 6 [January, 1920

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A REVIEW OF MINING IN CALIFORNIA DURING 1919

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CALIFORNIA STATE PRINTING OFFICE
SACRAMENTO
1920

CONTENTS.

	Page
LETTER OF TRANSMITTAL	5
OUTLINE MAP OF CALIFORNIA	6
INTRODUCTION	7
REDDING FIELD DIVISION	7
Scope of Industry in District	7
Copper Mining	7
Gold Quartz Mining	9
Dredging	10
Hydraulic Mining	10
Silver	11
Chrome	11
Other Minerals	11
Production for the Year	11
Outlook for 1920	12
Labor Situation	12
Generally Recognized Needs of the Industry	13
AUBURN FIELD DIVISION	13
Scope of the Industry	13
Hydraulic Mining	14
Drift Mining	14
Gold Dredging	14
Quartz Mining	14
Industrial Minerals and Base Metals	19
Production for the Year	21
Outlook for 1920	22
Labor Situation	23
Generally Recognized Needs of the Industry	23
SAN FRANCISCO FIELD DIVISION	24
Scope of the Industry	24
Production for the Year	24
Quicksilver	24
Magnesite	26
Gold	26
Chrome and Manganese	28
Cement	28
Stone	28
Brick and Tile	28
Salt	28
Zinc	29
Copper	29
Labor Situation	29
Generally Recognized Needs of the Industry	29
LOS ANGELES FIELD DIVISION	30
Variety of Minerals Produced	30
Mines and Plants	30
Borax	30
Clay and Clay Products	30
Outlook for 1920	32
Copper	32
Chromite	33
Diatomaceous Earth	33
Dolomite	33
Feldspar	33
Fullers Earth	33
Gems	34
Gold	34
Graphite	35
Gypsum	35
Lime	35
Limestone-Cement	35
Magnesite	36
Manganese	36
Potash	36
Outlook for Potash Industry	36
Pumice	36
Quicksilver	37
Lead, Silver and Zinc	37
Outlook for Future	38
Silica	38
Soda	38
Stone Industry	38
Talc	38
Tungsten	39
Labor Situation	39
Tariff Protection	39
PETROLEUM	39
ESTIMATED CALIFORNIA MINERAL PRODUCTION IN 1919	42

LETTER OF TRANSMITTAL.

To His Excellency, the Honorable WILLIAM D. STEPHENS,

Governor of the State of California.

SIR: I take pleasure in submitting herewith Preliminary Report No. 6 entitled "A Review of Mining in California during 1919," which includes notes on the mining outlook for 1920, labor conditions, and needs of the industry.

The information contained herein has been made available as a result of the Bureau's recently inaugurated system of establishing branch offices in the mining regions of the state. No attempt has been made to present the material in particularly finished form, its value lying in the timeliness of its appearance and the definite manner in which the subject is discussed.

It is believed that this publication marks an innovation which will be appreciated by the general mining public, inasmuch as such authentic information is rarely to be had until much later in the year, if at all.

Respectfully submitted.

FLETCHER HAMILTON,
State Mineralogist.

January 1, 1920.

CALIFORNIA STATE MINING BUREAU
FLETCHER HAMILTON
STATE MINERALOGIST
OUTLINE MAP
OF
CALIFORNIA
SCALE
OREGON
NEVADA
PACIFIC OCEAN
MEXICO
SISKIYOU
MODOC
ALTURAS
TRINITY
SHASTA
REDDING
LASSEN
SUSANVILLE
HUMBOLDT
TEHAMA
RED BLUFF
PLUMAS
QUINCY
GLENN
BUTTE
OROVILLE
SIERRA
NEVADA
MENDOCINO
LAKE
COLUSA
YUBA
PLACER
EL DORADO
PLACERVILLE
YOLO
SONOMA
NAPA
SOLANO
AMADOR
ALPINE
CALAVERAS
MONO
MARIN
CONTRA COSTA
SAN JOAQUIN
STOCKTON
TUOLUMNE
SAN FRANCISCO
OAKLAND
ALAMEDA
STANISLAUS
MODESTO
MARIPOSA
SAN JOSE
SANTA CLARA
MERCED
MADERA
FRESNO
INYO
SAN BENITO
SALINAS
MONTEREY
VISALIA
TULARE
KINGS
HANFORD
SAN LUIS OBISPO
BAKERSFIELD
KERN
SAN BERNARDINO
SANTA BARBARA
VENTURA
LOS ANGELES
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
LEGEND
Mining Division Boundaries.
Mining Division Offices.

A REVIEW OF MINING IN CALIFORNIA DURING 1919.

By Fletcher Hamilton, State Mineralogist.

The State Mining Bureau now has permanent field representatives in specifically assigned districts of California, and as a result of the personal contact with the mining industry thus achieved it is possible to approach nearer the goal toward which the Bureau is working, than at any time in its past history.

This goal is the carrying out, in letter and spirit, of the organic act under which the Bureau functions, which provides that its fundamental purpose shall be to aid in all possible ways in the development of the mineral industry of the state.

The above mentioned districts, with engineers in charge, are as follows:

Redding Field Division, E. Huguenin.

Auburn Field Division, C. A. Logan.

San Francisco Field Division, E. S. Boalich.

Los Angeles Field Division, W. B. Tucker.

REDDING FIELD DIVISION.

1. Scope of Industry in District.

The principal minerals mined in this district are copper, gold, platinum, silver, zinc and pyrites. During the war chrome ore was developed and produced in Del Norte, Shasta, Siskiyou, Tehama and Trinity counties. Asbestos, cadmium, clay, coal, iron, limestone, manganese, mineral water, quicksilver, volcanic ash and pumice have all been produced to a lesser extent, but the industry is dependent mainly upon the first group, each mineral of which will be considered separately.

COPPER.

Most of the copper produced in northern California is mined within a radius of twenty-five miles of Redding, in Shasta County, although there has been a considerable amount produced in Trinity County during the past few years. Siskiyou County has contributed a comparatively small production, as the copper deposits there are mostly beyond the present limits of economic transportation. In this regard the construction of the state highway down the Klamath River will be an important factor, as there are a number of deposits in that region. Notable among these is the Gray Eagle mine, owned by the Mason Valley Mines Company, of Nevada. It is estimated by the manage-

ment that over a million tons of chalcopyrite ore has been revealed there.

Practically all of the copper and zinc ore produced in Shasta County during the past year was mined by the five established companies as follows: Mammoth Copper Mining Company, Balaklala Consolidated Copper Company, Mountain Copper Company, Bully Hill Mines, Inc., and the Afterthought Copper Company.

During the war the ore bodies at the Mammoth mine were greatly depleted as all efforts were made to stimulate production so that comparatively little development work was done. This company continued to produce copper until the smelter was forced to shut down due to labor troubles in May, 1919. Since that time development work only has been done and a crew of sixty men are at work. Drilling operations at the Keystone mine of this company is proving the existence of a large ore body there. It has not as yet been decided when the smelter will be again blown in; this will be determined when the ore reserves approach their former status.

The Balaklala Consolidated Copper Company ceased mining in May with the closing of the Mammoth smelter, as all ore from that mine is smelted there. Development work was carried well ahead of stoping so that the company will be in position to produce ore as soon as the smelter is ready to receive it. The superintendent estimates one year supply (about 100,000 tons) blocked out ready for stoping.

At Iron Mountain the Mountain Copper Company continues to produce about 400 tons of pyritic ore daily from the Hornet mine, the only one of that group now being worked. As this ore body runs low in copper, less than one per cent, the greater portion is marketed for its sulphur content. The company utilizes some of it at their chemical plant for the manufacture of fertilizer. Since the closing of the smelter at Martinez in March no copper ores from the Iron Mountain mine have been mined and the oil flotation mill at Minnesota Station is idle. The ore reserves at the Hornet mine are enormous and the crushing plant below the mine has a capacity of 1000 tons daily. About 150 men are employed by the company, the normal force being 500.

The Bully Hill Mines, Inc., have been following a plan of development for the past two years at their Rising Star mine, to determine the extent of the copper and zinc ore bodies. In connection with this work a 150-ton capacity oil flotation plant was built to concentrate this ore. The mill, completed just as the war ceased, was operated but a few months, long enough, however, to prove that a selective concentration of these base ores was practical. As it is impossible to ship the zinc concentrate to Eastern smelters at a profit, due to excessive freight

and treatment charges, it is expected to install a plant for the manufacture of zinc oxide at the property. The flotation mill will concentrate the medium grade zinc and copper ores, while the high grade zinc ore, running 30 to 45 per cent Zn, will be treated without concentration.

At the Afterthought mine about a hundred men are at work. The orebody has been encountered on the eighth level, the lowest working, which was recently driven to cut it. A successful metallurgical treatment for this copper-zinc ore has been developed. This consists of making a selective concentration of the copper and zinc in the 300-ton oil flotation mill. The copper concentrate is roasted in a 9-hearth Wedge type roaster, then smelted in a reverberatory furnace, producing at present a matte which runs 18 to 20 per cent Cu. The furnace also treats the silicious copper ores from the mine which contain very little zinc. About 135 tons daily of this ore and concentrate is being smelted. The zinc concentrate is being stored for future treatment, as the company expects to put in an electrolytic zinc plant.

Besides the five producing companies described above there are two others that have been doing considerable work the past year, as follows: Atascadero Mining Company, who have taken over the Greenhorn mine, and the Pittsburg and Mount Shasta Mining Company, operating the Little Nellie. The Greenhorn mine, situated about twenty miles northwest of Redding, has produced at various times considerable copper ore which was shipped to the Mammoth smelter. Early in 1919 it was acquired by the present owners who are developing a large body of low grade sulphide ore. It is reported by the manager, Mr. A. Hanford, that there is at present about a quarter million tons blocked out that will average a little better than 3 per cent. Experiments for a chemical treatment for this ore, whose gangue is principally iron sulphide, have been made at the plant of the parent company, Metals and Chemical Extraction Company, at Melrose, and it is expected to build an acid leaching plant at the mine in the near future. The Pittsburg and Mount Shasta Company's property adjoins the Hornet mine on Iron Mountain. Here diamond drilling on the main adit of the Little Nellie mine, formerly worked for gold, is said to have proven the existence of a body of chalcopyrite ore. A contract was recently let for the sinking of a 500 foot shaft and a crew of twelve men are at work.

GOLD.

Gold mining in this district, as in all others, is under a severe handicap due to high costs so that most of the larger mines are now idle. The French Gulch district, the most famous gold producing district of

the north, is dormant. The two principal mines in Shasta County now in operation are the Reid mine at Old Digging and the Midas mine in Harrison Gulch. The Reid is a low grade gold quartz mine which ships all of its ore to the Mammoth smelter, supplying it with silica for flux. The striking of a rich ore shoot at the Midas during the past year is of particular interest, as the mine, credited with a production of over three and one-half millions, is generally thought to be worked out. A new reduction plant equipped with four 30-ton Gibson mills is treating the ore, and a force of twenty miners is at work.

In Siskiyou County a number of the old mines were reopened, including the Eliza, Highland, Hoboken, Homestake, and Quartz Hill mines, all of which are again producing gold.

In Trinity County also several of the old producers are again being developed. Twenty men are working at the Bonanza King mine, above Carrville, and the stamps are dropping on high grade ore. The Globe mine, above Dedrick, has been acquired by Buckley Wells and associates, and considerable development work is in progress. The Fairview mine, near Minersville, is also being reopened; the old 40-stamp mill, however, has been dismantled. In Lassen County, the Juniper mine at Hayden Hill is the only one of the district being developed. Several prospects in the vicinity of Westwood are being developed in a small way. With the exception of the Hess mine, where a few men are at work, gold mining in Modoc County is at a standstill.

There has been increased activity and production of gold dredging during the year. The following gold dredges are at present operating:

Shasta County: 3 dredges.
L. Gardella, 2 dredges on Clear Creek.
American Gold Dredging Company, 1 dredge on Sacramento River.
Siskiyou County: 2 dredges operating.
El Oro Dredging Company, 1, mouth of Greenhorn Creek.
Siskiyou Dredging Company, 1, McAdams Creek.
Trinity County: 4 dredges operating on Trinity River.
Estabrook Gold Dredging Company, 1.
Pacific Gold Dredging Company, 1.
Trinity Dredging Company, 1.
Valdor Dredging Company, 1.

The dredge of the Estabrook Company, which is said to be the largest wooden dredge in the world, is equipped with 20-foot buckets. It started digging last June.

Due to the unusual circumstance of having a succession of dry years with little snowfall in the mountains, the few hydraulic and placer mines that could withstand the high operating costs were able to be worked but part of the normal season. The Le Grange mine, largest hydraulic mine operated in recent years, was forced to suspend operations last year, due to high costs. Several of the placer mines along

the Klamath River are preparing to resume work in the spring and some of the old ditch lines are being repaired. The Rexbury hydraulic mine on the Scott River, near Hamburg, is again at work.

SILVER.

Some attention is being given to the silver mines in the vicinity of Igo, Shasta County. The 3000-foot adit of the old Chicago mine is being cleaned out and track laid, preparatory to further development work.

CHROME.

As previously stated, chrome mining became an important industry in this district during the war, as many deposits were developed in the serpentine areas of Del Norte, Shasta, Siskiyou, Tehama and Trinity counties. The sudden collapse of the market last year put an abrupt end to it. Many hundred tons of chrome ore were hauled to points along the railroad in both Shasta and Siskiyou counties just before the market broke, so it was not shipped. Under a more favorable market large tonnages of this ore would be mined. The enormous low grade ore bodies that have been revealed in the Klamath River region offer excellent inducement for concentration, especially as water power could be developed at most of them with little cost.

OTHER MINERALS.

Other minerals that have been produced to a lesser extent are asbestos, coal, iron, limestone, and quicksilver. A small amount of platinum is recovered in gold dredging and occasionally at the larger hydraulic mines. Within the past few months a discovery of this precious metal was reported to occur near the head of Beegum Creek, about fifty miles southwest of Redding.

Very little work has been done on the iron ore deposits along the Pit River since the closing of the Noble Electric Steel Company's furnace at Heroult. An occasional carload of the iron ore is shipped to the Judson Iron Works on San Francisco Bay. As the Noble Electric Steel Company is in the hands of a receiver it is very doubtful when operations will be resumed at that smelter.

Comparatively little attention has been given to the extensive limestone deposits of Shasta County, and only those in the vicinity of Kennett have been mined during the year, supplying the Mammoth smelter with flux.

2. Production for the Year.

The copper and zinc production of 1919 will be less than one-half of that of 1918. This is due to the closing of the Mammoth smelter in May, which treated ores from the Balaklala and Bully Hill mines as

well as those of the Mammoth company, and the closing of the Mountain Copper Company's smelter near Martinez. Production of copper matte at the Afterthought and shipments of high grade ore from the Bully Hill constitute the present copper production of this district.

Gold production should show an increase over the 1918 figures due to the reopening of the several producing mines listed previously, and the increase in gold dredging. It will not, however, approach the production of those years just previous to the war.

Silver production will be less, probably in close proportion to the copper production, as the greater amount of this metal recovered is associated with the copper and zinc ores. The increase in the amount associated with gold will be comparatively small.

Pyrite production will equal if not exceed that of 1918, as the Mountain Copper Company continue to ship about 400 tons of 45 per cent ore from the Hornet mine.

No chrome ore was produced during the year.

Both iron ore and limestone production will be very much less than that of 1918, due to the closing of the Mammoth and Heroult smelters.

3. Outlook for 1920.

There should be a heavy increase in the production of copper, silver and zinc in 1920 under favorable market conditions, due to the developments outlined above at the various properties, and the operations of their reduction plants, as listed below.

Afterthought Mine. 300-ton oil flotation plant for selective concentration of copper and zinc; 200-ton reverberatory furnace for producing copper matte. Proposed erection of electrolytic zinc plant.

Bully Hill Mines. 150-ton oil flotation plant for selective concentration of copper and zinc. Proposed erection of zinc-oxide plant.

Greenhorn Mine. Proposed acid leaching plant and chemical works.

Iron Mountain. 500-ton oil flotation plant of Mountain Copper Company. Reverberatory furnaces and acid works at Martinez; 1000-ton crushing and sorting plant of Hornet mine.

Mammoth Mine. Renovation of the 1000-ton custom smelter.

Gold production should be greater in 1920 than in 1919, but comparatively little quartz mining may be expected here until there is a decrease in the high price level. Dredge operations will be probably more extensive as several tracts of river land in both Shasta and Trinity counties are being prospected for that purpose.

4. Labor Situation.

During the war there was a shortage of miners in the district, as many deserted the camps here for the copper camps of Arizona,

Nevada and Montana where higher wages prevailed. With the closing of the larger mines here in the spring, many men were out of work and since that time labor has been plentiful. The wages paid at all of the camps here are now $4.50 for miners and $4 for muckers, as compared to $4 and $3.50 paid them last year. A few years ago the wages were $3.50 and $2.75. All of the companies operating report that at the present wage scale labor is plentiful.

5. Generally Recognized Needs of Industry.

The greatest needs of the mining industry here are better transportation facilities and lower freight rates, particularly on custom ores. The copper camps of Shasta County are easily accessible to railroad points, the most distant ones such as Bully Hill and Afterthought owning narrow gauge lines which connect with the Southern Pacific Railroad. Those of Siskiyou County, however, are all at considerable distances from shipping points and can be operated only under the most favorable conditions. The gold camps are all rather inaccessible and dependent upon motor truck transportation for their supplies. Most of those of Trinity County are isolated during the winter months as the old county roads become impassable in wet weather. The new state highway system will be a great aid to many of the districts, notably the Redding–Weaverville lateral, giving access to French Gulch, Deadwood and Lewiston districts; the Klamath River highway, following the Klamath from Hornbrook in Siskiyou County to its mouth at Requa, Del Norte County; and the Redding–Alturas lateral which will give access to isolated districts in Lassen and Modoc counties. These highways will be kept open all year upon completion and should reduce materially present transportation costs.

AUBURN FIELD DIVISION.

1. Scope of the Industry.

The district has valuable deposits of the following minerals: Asbestos, barite, brick clay, building stone, coal, chromite, copper ores, fire clay, glass sand, gold, granite, iridium, iron ores, limestone, manganese, magnesite, marble, mineral pigments, mineral water, molybdenum, osmiridium, platinum, pumice, pyrite, quartz crystals, slate, soapstone, tungsten and zinc. There are, of course, a great many occurrences of other minerals which are principally of scientific interest.

The district comprises the foothill and mountain counties on the western slope of the Sierra Nevada Mountains. In the middle courses of the rivers which flow down this slope, from the points where they break from their rocky canyons to the region of their flood plains, are located the gold dredging fields. Eastward, beyond the mantle of younger sediments in the area of metamorphic rocks, are the foothill

copper belt, the Mother Lode, the East Belt, and the Nevada County gold belt, as well as the promising quartz veins of Placer, Yuba, Butte and Plumas counties. At the north lies the great copper belt which is being opened at the Engels and Walker Brothers mines, but the exact extent of which is not yet known. Traversing the Sierra slopes from east to west are the deep Tertiary auriferous gravels marking the courses of the ancient rivers. All through the mountains and foothills are to be found deposits of industrial materials.

Hydraulic Mining. Much has been said and written about the means that ought to be taken to revive hydraulic mining in the Sierra Nevada. Without going into the feasibility of these schemes, it may be said that hydraulic mining on a large scale, as it was carried on in the eighties, will probably never be seen again. However, there is a renewed interest in this form of mining by the use of restraining dams which prevent the debris from being carried down the streams into the Sacramento River. Particular activity has been noted in the Brandy City district and other operations have been reported in Plumas, Sierra and Nevada counties.

Drift Mining of deep gravels offers a wide and promising field in this region. Where pumping and hoisting can be obviated, there is a chance even under present adverse conditions, to operate at a profit a large number of properties. Under favorable conditions the cost of operation today need not exceed $2 a ton; so it is only natural that there is a great deal of development of small drift mines going on now in the mountain counties. The Keystone drill is being used more and more for prospecting buried gravel and marks a great advance over the old way of blind burrowing with pick and shovel.

Gold Dredging continues with less serious interruption than other branches of mining, the main difficulties encountered having been the increased cost of electric power, the cost and scarcity of steel equipment, and demoralized transportation. New construction was nearly impossible during the war, but for boats already built the increased cost of operation was not critical. Some of the older fields are becoming exhausted. Future production can not be expected to increase except as it may be speeded up by increased operations in three or four fields. There are no more great fields left to discover in the state.

Quartz Mining. The past year has seen the temporary closing of four of our principal producing mines and the protracted or final closing of many smaller ones whose owners do not feel justified in trying to mine under present adverse conditions. The North Star and Empire lost considerable time on account of labor troubles, and the Argonaut and Kennedy because of fire and gas. The Morgan mine, a phenomenally rich producer, entered the lists early in the year,

however, and its output has done much to compensate losses from other sources. Gold dredging, too, has no doubt shown some increase.

Starting at the southern end of Tuolumne County, we find the Belmont Shawmut operating at two-thirds capacity, milling three hundred tons of typically low grade Mother Lode ore a day. This company is using stamps, Jones-Belmont flotation machines and tables. This company is mining and milling for less than any other noted on the Lode or elsewhere, because they have large reserves of ore opened, but the margin of profit is not what it should be. Flotation gives good recovery, but the smelter objects to handling the concentrates because, they claim, the oil used discolors the sulphuric acid which is made as a by-product before the gold is recovered. There is also the difficulty of keeping the concentrates clean enough without an unduly high loss in the tailing. The smelter wants 25 per cent excess of iron over silica, and imposes heavy penalties if this proportion is not maintained. With a $50 concentrate there is a tailing loss of 41 cents; with $39 concentrate, the loss is said to be 30 cents. With low grade ore the difference of 11 cents is critical.

Farther north at Quartz the Dutch–App group under the direction of William J. Loring is being reopened and milling is going on at one-third capacity. This company uses Hardinge mills, sluice plates, Mineral Separation and K & K flotation machines and Wilfley tables. On account of operating on a reduced scale, costs are high now and not representative.

In Calaveras County the condition of mining on the Mother Lode is a little better than in Tuolumne. Entering the county at the south, we find the Melones mine shut down with scant prospect of reopening. Low grade ore, increasing cost of operation and boundary troubles with neighbors all conspired to stop operation. Directly adjacent to Melones the Calaveras mine is being prospected on a working scale by the same company working the Morgan mine, under the management of William J. Loring. Even with the high costs incident to development and small scale operation, some ore shoots have been opened that can be mined profitably, and the map of surface tests indicates a good sized property.

The successful operation of the Morgan mine has been the sensation of the year in California mining. To date nearly 60,000 tons of ore have been milled since January, 1919. The average heads for the first six months were $14.30 a ton and have shown constant improvement, going over $16 a ton in September. Milling consists of crushing to 20-mesh with twenty 1250-pound stamps, classifying, overflow going over plates, and sand to Hardinge mills for regrinding; thence over plates to Deister simplex sand concentrators and Deister Plat-O sand

tables. The product is subsequently cyanided. The finding of such a fine orebody on the hanging wall of the bull quartz vein illustrates well the chances of mining. Only a few feet away the Melones company has worked for years on the footwall side of the same vein, on very low grade ore, and had attained a depth of 3500 feet on the vein with very little ore on the hanging wall side of the bull quartz. On the 550-foot level the Morgan ore shoot is 165 feet long and 31 feet thick; on the 675-foot level, 150 feet long and 30 feet thick, and it is strong on the 865-foot level. With such ore the cost per ton is not so important as to the ordinary Mother Lode operator, the cost of mining and milling, with the exception of certain items for conveying and railroad freight are representative of what it costs to mine a large orebody in California now. The following figures for July and for the preceding six months have been kindly furnished by Mr. Loring:

Driving	$8 87
Cross-cuts	7 82
Raising	14 22

Mining items—ton mined.

Labor	$0.776
Explosives	.193
Timber	.041
Carbide	.009
Tools	.063
Steel	.015
Sundry	.033
Power	.042
Sampling and assaying	.014
Repairs and maintenance	.036
Surveying	.004

Ore treatment costs, including crushing, conveying, railroad freight, marketing and tailing loss.

	July	Six months period
Crushing and conveying	$0.075	$0.097
Railroad (ore)	.421	.514
Stamping	.246	.239
Amalgamating	.080	.094
Regrinding, Hardinges	.209	.204
Concentrating	.055	.107
Treating tailing	.039	.031
Disposing of residue	.003	.004
Marketing concentrates (including pump sand and slime and tailing loss)	1.061	1.159
Marketing bullion	.049	.029
Total	$2.238	$2.511

Summary of cost of operation on basis of tons milled.

Ore extraction	$1.635	$1.819
Milling	1.128	1.324
Marketing	1.110	1.188
General expense	.752	.805
Total operating	4.625	5.136
Development	.414	.648
Total	$5.039	$5.784

The high cost of transportation is due to the hauling of ore over the Sierra Railway about three miles from the mine to Melones, where the mill was built with the idea of using it for both the Calaveras and

Morgan mines. There is direct underground connection from the Morgan mine through the old Melones workings to a point not far from the new mill and if this fact could be taken advantage of the cost of operation could be reduced probably to about $4.75 a ton. This figure represents about as low a cost of operation as can be hoped for at present. Any property working Mother Lode ores for less is doing it either at the expense of the future of the property or because, as in the case of the Belmont Shawmut, they have ore blocked out ready to mine for a long time to come, and do not have to carry on current exploration and development.

The only other producer of consequence on the Mother Lode in Calaveras County is the Gold Cliff mine of the Utica Company. The deepest working level of this mine is at 1900 feet. They are running forty stamps and milling 225 tons a day. The ore is of good grade and the company is making some profit. The Utica, Angels and Lightner mines appear to be closed permanently.

In Amador County the most important setback to production has been the fire which broke out in the Argonaut on March 27 and also affected the Kennedy. The mill at the Argonaut lost about two months time.

The South Eureka was closed early in 1918 because of impoverishment of ore, increased costs and unwillingness of stockholders to spend more money at present for sinking and exploration. The old Eureka has so far made no production.

The Central Eureka is now operating at depths of from 3500 to 3700 feet, and have an ore body which shows considerable free gold. Here again persistence has won and the company reports show the mine in the best condition for over ten years. The full plant of forty stamps with a capacity of 5000 tons a month has recently resumed operation, and operations for October show a net profit in spite of the fact that the closing of the South Eureka makes it necessary for the Central Eureka Company to pump the water from both mines. The ore in the new shoot is comparable in grade to that found at the Morgan mine, although of course geological conditions are different. Success at the Central Eureka is bound to have a good influence on its neighbors.

From Sutter Creek to Plymouth a long stretch of the Lode has recently been supporting only three producers, the Treasure, Keystone and Bunker Hill. The Fremont, in operation about twenty-five years, closed late in 1918. It had a mill capacity of 6000 tons a month and was operating on typical Mother Lode ore. The Keystone has been shut down during the past month until the tailings dam could be raised. The Bunker Hill and Keystone have been

operating at practically no profit, if not at an absolute loss, during the past few years. The cost of operation and the output have been about equal, and neither property has been able to carry on the requisite amount of development work. Costs have been over $4 at the Bunker Hill.

Plymouth Consolidated at last account had a cost of about $4.60 a ton. In spite of the average low grade of most of the ore handled, this property returns a net profit because they frequently find small bodies of rich ore which raise the average value of mill heads a good deal. According to Mr. Loring these rich shoots have come with comforting regularity.

There are no producers on the Lode north of Plymouth at present.

The consequences of the labor strike at Grass Valley in June have been felt all summer, as normal operations in the deeper levels of the Empire and North Star were not resumed till late in September. Cost of mining has been given another boost by the 10 per cent raise promised to all men who remain in the service of the respective companies for three months at least. The bonus system in the North Star was unsatisfactory and was superceded by the new agreement.

The Golden Center and Union Hill mines, both producers, have closed down during the summer. The Empire is adding twenty stamps to its mill in preparation for closing the Pennsylvania mill; the Pennsylvania ore will be trammed to the Empire mill in the future. The Norambagua and Kenosha are being reopened and both should become producers soon.

Two larger and promising ventures are the reopening of the old Idaho–Maryland preparatory to exploration, and the formation of a company to unwater and explore the Bullion group. These projects will both require a lot of time and money, but fortunately they both seem to be in the hands of capable companies with ample finances.

At Nevada City the Champion mine of the North Star Company remains the only producer, but plans are under way for the opening of two other mines next spring. Good ore has been found in the deep levels of the Providence in the Champion group and profitable operation can be expected after a long period during which the property has been a burden to the company. The ore contains 6 per cent or more of sulphides and is amenable to flotation, which process may be installed.

In Sierra County the Alleghany district has been very quiet, with only a few batteries of stamps running. The Tightner and Plumbago have been closed and operation of the Sixteen-to-One and Twenty-One have been interrupted by a lawsuit arising out of alleged invasion of the Sixteen-to-One vein by the other company. The Tightner and

Sixteen-to-One will resume work soon, the former under new management. There is not known to be any good ore in sight in the Tightner, but the new operators are relying on the mine repeating its past history. The Monarch and Cleveland properties near Sierra City have been in steady operation this summer.

Industrial Minerals and Base Metals.

The gold mining industry in the district is of predominating importance, and has overshadowed the possibilities which lie dormant here for the development of many enterprises which depend on the humbler members of the mineral family. The metamorphic rocks of the Sierra Nevada contain many valuable deposits other than gold, and a few of these will be mentioned.

Asbestos has been mined and milled lately in two localities, in Nevada and Calaveras counties. The former property is equipped with a remodeled stamp mill and a fiberizing plant. It has been successfully operated for two seasons, turning out four or five grades of chrysotile asbestos. The better grades have been sold in competition with Canadian fiber, and the lower grades, including that classed as asbestine, have been used in patent composition flooring and stucco made by a San Francisco firm.

Barite is being mined at a Nevada County property which was first worked this year. It shows a large enough tonnage actually in sight to supply the Pacific Coast for at least a decade, and a process of refining it has been worked out which promises to relieve the local consumers of the necessity of bringing in barite from east of the Rocky Mountains.

Chrome. The market shows some life. There have been some sales of high grade ore at 50 cents a unit, and some small contracts have been entered into at this price, f.o.b. shipping point. One plant making a 50 per cent concentrate has just resumed milling, and two others are reported getting ready to produce. The demand is small, however, and as far as the producer of low grade ore is concerned, there is little future unless he has a mill, near the railroad. El Dorado, Placer and Nevada counties were leading producers during the war.

Copper production has been curtailed or suspended at many properties pending a rise in the market, but many mines are active in the Plumas copper belt. The Engels Copper Company will probably be the state's leading producer again this year. Walker Brothers mine has been keeping several large auto trucks busy hauling concentrate this summer, pending the completion of a new tramway to the Western Pacific Railway. Several small properties have been active near Engels but the full extent of this copper belt has not yet been determined.

Engels Copper Company has been very fortunate in treating their ore by straight flotation as there is no iron sulphide in the ore and the result is a product of much higher copper content than is possible with the ores of Calaveras County. In the latter county there have been some closures of properties and a curtailment of operation in general.

Granite of fine quality occurs in Placer County in abundance near the railroad and the business of cutting it for building purposes formerly gave work to several hundred men. Demands of labor for higher pay and competition of artificial building products have driven this stone out of the market, and there is very little being done with it now.

Manganese mining is dead except for small shipments of high grade ore from one property.

Limestone of various grades is abundantly distributed in the district, especially in El Dorado and Tuolumne counties, but few deposits have been utilized as yet. One quarry in El Dorado County turns out 1200 tons daily which is shipped to a bay county cement plant. Two or three other quarries yield small tonnages, but the full utilization of our limestone awaits the exhaustion of deposits nearer the bay region.

Marble of fine quality occurs in immense beds in Tuolumne County. This stone is superior in hardness and compressive strength to any other with which it has come into competition and is obtainable in all gradations of veining, from pure white to dark gray. It has established a place for itself in the Pacific Coast market, but has not been able to compete in other fields on account of transportation costs. At present there are very few large buildings being constructed and two quarries are working at only part capacity.

Many molybdenum prospects were found in the granite areas of the Sierra Nevada during the war. There was no production worth mentioning in the state, however, and nothing is being done with the properties which are known in Placer, Sierra, Nevada and Plumas counties.

Platinum, osmiridium and iridium are recovered from gold dredging operations in practically every field in this district. The quantity is small, being in all about 600 crude ounces a year for the state, but it represents most of the domestic production of these metals. The dredgers of the Yuba and American rivers recover most of this.

Pyrite was produced during the war from one property in El Dorado County and was used to make sulphuric acid. At present the concentrates from gold mines in the district are treated for a like purpose before the recovery of the gold. In normal times the supply of raw material for acid making far exceeds the local demand, and

transportation cost precludes the idea of going farther east for a market.

Quartz for flux and other uses is plentiful in the district. A new industry sprang up in Amador County during the war to supply clean quartz sand for glass making. At present there is a plant in operation in that county to supply pure quartz sand for the manufacture of sodium silicate. The sand of the Ione formation is washed and separated from clay, chromite and other dark minerals which occur in it in small quantity. The final separation is made on ore concentrating tables.

Slate of excellent quality for roofing occurs in El Dorado County, but there is no present market for it.

Soapstone is being mined in El Dorado County for use in ready roofing and fireproof paints. It finds a market in the state.

Tungsten was mined during the war in the Union Hill mine near Grass Valley.

2. Production for the Year.

Exact figures of production can not be given at present, but there is enough data at hand to give an idea of the probable output compared with the year 1918. On the Mother Lode, Tuolumne and Amador counties will show a considerable decrease in production on account of the closing during 1918 and 1919 of the following mines, either permanently as seems now to be the case with the South Eureka, Fremont, and Amador Consolidated; or temporarily as in the case of the Keystone, Argonaut and Kennedy. Exhaustion of ore reserves in some properties and shortage of labor may also tend to lower the tonnage of ore and reduce gross yield. The output may be 20 per cent lower than last year.

In Calaveras County there will be a big gain in yield. The Angels mine, with a capacity of 6000 tons a month, quit work in March, 1918, and Melones mine, with a capacity of 15,000 tons a month, quit milling in February, 1919. To balance these losses there will be the production of the Morgan mine, and the net gain from this source will probably give the county a gold output of at least half a million dollars in excess of that for 1918.

In Nevada County there may be a decrease of at least 10 per cent in gold production as compared with that of 1918.

Sierra and Plumas counties may maintain their output as the result of contemplated operation of hydraulic and drift mines, even though there has been little quartz mining in either county this year.

Butte County, because of the exhaustion of the Oroville dredging field, will show a large decrease in gold yield.

Yuba County will no doubt show some gain. There has been a tendency to increase the scale of operation in the Hammonton field for many years and this has been reflected in a steady increase in gold production since 1915. The present season has been favorable for dredging as there has been no high water yet to hinder work. The other dredging fields should maintain about the same rate of yield as last year.

There has been some enlargement of hydraulic mining operations which may result in a small increase in production. No new producing drift mines of importance have entered the field, and though the drift mining industry offers great promise most of the properties visited are in the development stage.

3. Outlook for 1920.

On the Mother Lode there is definite promise of increased gold production in 1920 from the Dutch–App group in Tuolumne County, the Morgan and Calaveras Consolidated mine in Calaveras County, and the Central Eureka in Amador County. There are other properties capable of increasing this year's figures if they can get more and better labor next year. Besides these, there are some mines in the prospective stage which may develop favorably during the year. If conditions do not improve there will be further closing of low grade properties, which are holding on at present in the hope of better times. If the statements of operating officials are correct, there is a possible loss of over 125 stamps from this cause.

The East Belt in Tuolumne and Calaveras counties promises production next year. The mines looked to for this are the Sheep Ranch and Black Wonder in particular, and there are some others in the West Point and Railroad Flat districts in Calaveras County and in the Tuolumne and Confidence districts in Tuolumne County which ought to become productive. This region has problems in ore treatment to solve.

If conditions permit steady operation next year there should be increased yield from operations in Nevada County. In spite of labor unrest and costs of operation, conditions are much better here than on the Mother Lode. The Norambagua, Champion and Kenosha should help to swell the steady production which may reasonably be expected from the North Star and Empire. The Idaho Maryland is already unwatered to the 400 foot level. Conditions underground will entail considerable dead work before real production commences.

There are no particular reasons at present for expecting actual production at an increased rate from quartz mining in the other counties of the group, but all conditions point to increased interest in mining and a return of capital to legitimate mining projects.

In drift mining, however, there is room for optimism. Many properties have been brought during the past year to a point of development where actual production should begin soon. These properties are located chiefly in Placer, Sierra and Plumas counties. It is true that many of them are employing only a few men, but once opened and shown to be profitable, they will possess great possibilities.

4. Labor Situation.

Labor is scarce in nearly every camp in the district and some operators state that they are not able to do the needed amount of advance development work because of this scarcity. The quality of service rendered is also said to be far below pre-war standards. Men are not particular whether they keep a given job or not, as there is usually another waiting for them. Where the scale was formerly $2.50 to $3 a day, it now runs from $3.50 to $4.50 for underground work. These figures are reflected in increased cost of operation in mining as in every other business, but the gold miner has no present means of relief.

5. Generally Recognized Needs of the Industry.

The easiest way and the quickest way to solve the gold miners' difficulties would naturally be to raise the value of his product. It is suggested that this could be done without disturbing the financial balance of the world, if the government could find some way of controlling the total output of the country's gold, taking so much of it as may be required for coinage at the present rate, and establishing for the remainder, which is used solely in the arts, a higher price than the present standard. This would require the accounting for all coined gold, but most of this appears to be in the hands of the government anyway, so this step would not be as sweeping perhaps as it seems. The government would be then the sole dealer in gold. The result would in effect be a tax on those industries using gold and as times returned to normal this tax could be lightened.

Putting aside the possibility of this, there are certain remedies that could be applied to help gold mining in California. One of these is a lower industrial accident insurance rate. Another remedy is government control of prices of explosives, steel and other commodities used in mining. A third means of relief would be reduced railroad rates for concentrates enroute to smelters, especially from properties known to be operating at little profit.

SAN FRANCISCO FIELD DIVISION.

1. Scope of the Industry.

The San Francisco District, consisting of twenty-eight counties, embraces the Central, Western, and Valley counties of the state, extending from Mendocino and Glenn counties on the north, to and including Monterey, Kings, and Tulare counties on the south; also the southern Sierra Nevada District, covered by the counties of Fresno, Madera, Mariposa and Mono. The district includes about 300 miles of the Coast Range, with the foothills and valleys to the east, and also quite a portion of the foothill and high mountain belt of the Sierra Nevada; consequently a great variety of commercial minerals are produced, including most of the structural and industrial materials, as well as the metals.

The most important mineral products are: asbestos, barytes, bituminous rock, brick and tile, chromite, cement, clay, coal, copper, diatomaceous earth, dolomite, feldspar, gems, gold, granite, lead, lime, limestone, magnesite, manganese, mineral paint, mineral water, miscellaneous stone, natural gas, petroleum, platinum, potash, pyrite, quicksilver, salt, silica, silver, soapstone and talc.

In the order of their value, the several leading products of the district are as follows: (1) petroleum, (2) cement, (3) quicksilver, (4) gold, (5) miscellaneous stone, (6) brick and tile (including pottery clay), (7) magnesite, (8) salt, (9) manganese and (10) chrome.

Fresno County leads all others in the value of mineral products, due to the petroleum output. Following, in order of value of products, are Santa Cruz, Sacramento, Santa Clara, Napa, San Benito, Solano, Contra Costa and Alameda counties.

2. Production for the Year.

The district produces practically all of the quicksilver and magnesite which is marketed in the state.

Quicksilver mining has been an important branch of the mineral industry in California since 1850, during which period more than 2,000,000 flasks, having a market value of approximately $105,000,000, have been produced.

There are on record several hundred quicksilver mines and prospects in the state, but not more than ten of these have reported any production for 1919, and that production has been intermittent and small. The actual figures for the year are not now (December 11, 1919) available, but it is doubtful if the output of the state will exceed 17,000 flasks, as compared to 22,621 flasks in 1918. About 50 per cent of this output comes from the New Idria mine in San Benito County, which is equipped with five rotary furnaces and under normal conditions employs about four hundred men.

The Quicksilver Mining Company at New Almaden and the New Guadalupe, both in Santa Clara County, report a small production, probably about one-fifth normal.

The Oceanic mine in San Luis Obispo County had one of its two 50-ton Scott furnaces shut down for most of the year. The Western Mercury Company installed a rotary furnace at the Cloverdale mine, Sonoma County, and has made a considerably increased production for 1919. The Oat Hill mine, Napa County, has been reopened, and newly equipped with a 40-ton Scott furnace by the lessee, Mr. Murray Innes, owner of the Oceanic mine, San Luis Obispo County, and has been producing since January. New features of this installation include a multiple-flue series in the condensing system.

The only additional mines which have attempted to operate at all are the Rutherford in Napa County, the Helen mine in Lake County, the St. John's in Solano County and the Dawson Lease in Kings County operated by the Patriquin Company near Parkfield, Monterey County.

The present cost of production just about equals the market quotation for quicksilver, and as a result the industry is merely marking time. It appears to be an assured fact that without protection, presumably by tariff, quicksilver mining in the United States will become a thing of the past, and if such an event transpires the consumers of this commodity in the United States will undoubtedly pay a handsome price for the privilege of using an imported article.

The final analysis of the competitive conditions which confront domestic quicksilver producers may be outlined as follows:

First: The ore deposits of foreign countries are of much higher metal content than those found in the United States. Spanish ore is said to average 11 per cent, Italian ore 0.8 per cent and Austrian ore 1 per cent, while the average tenor of ore mined in this country is less than 0.5 per cent.

Second: The cost of labor in foreign countries is much lower than in the United States; in fact the Spanish mines are operated with convict labor.

In addition to the above points, it is worthy of note that the Almaden mine in Spain alone, with its 11 per cent ore operated by convict labor, and its output contracted to the Rothschilds in London at $34 a flask, has sufficient tonnage to supply the world for many decades to come.

Quicksilver is vitally necessary in the manufacture of fulminate, electrical apparatus, drugs, chemicals, and many other substances.

If the industry is to be preserved for the use of the nation it must be maintained in an operating condition, as the fact is well known that mines shut down and plants lying idle soon become inaccessible and worthless. The only sane conservation is that which would encourage

development of reserve ores and make possible a search for orebodies which today are unknown.

Magnesite.

Magnesite is produced, principally in the Porterville district in Tulare County, the Napa and Sonoma counties district north of San Francisco Bay, and in Alameda, Santa Clara and San Benito counties. At Porterville the Tulare Magnesite Company is operating at full capacity, calcining about 45 tons of crude ore per day, in one vertical furnace, which is kept burning continuously. A second furnace is operated at intervals for the purpose of burning "pure white" sorted ore.

The Porterville Magnesite Company is operating its large rotary kiln four or five days per week. About 70 or 80 tons of crude ore is being produced per day, and the kiln has a capacity of about 120 tons of crude ore per 24 hours, hence it is closed down two or three days per week, to allow sufficient ore to be accumulated for the next run.

The American Magnesite Company's plant at Porterville, which has been idle for some time past, has been purchased by C. W. Hill, who owns a controlling interest in the International Magnesite Company at San Diego. This plant will be in operation in a few days (November, 1919) calcining custom ore from many small properties around Porterville, Lindsay and Exeter. The outlook for 1920 is that there will be considerable increase in production from this district.

Gold.

Sacramento County is the leading gold producing county in the district; in fact, that county ranked fourth in the state, in gold production, in 1918. This is due entirely to the gold dredgers operating in the district around Folsom and Natoma.

The La Grange Gold Company's dredge, located at La Grange on the Tuolumne River in Stanislaus County, operated quite steadily during 1919, but at reduced capacity. Due also to the fact that the gravel deposit is not holding up to previous values, the output will probably be less than for 1918.

In Mariposa County several gold mines are operating on a producing basis. The Mountain King Mining Company, at Mountain King on the Merced River above Bagby, have been operating twenty of the thirty stamps in the mill, treating about 65 tons per day, which averages around $6 per ton. This company has its own power plant on the river, but on account of low water in the latter part of 1919 (October and November), the mine and mill were not operating continuously.

The Original Mining and Milling Company, at Clearing House, also on the Merced River, about seven miles below El Portal, are operating a ten-stamp mill, three shifts. Here also low water in the river cut

down the power, which is generated in the company's plant, to such an extent that a 25-horsepower gasoline engine was installed to run the mill. In October, 1919, several hundred tons of $4 to $5 ore, which had previously been thrown on the dump, was being milled, because of lack of power to run the compressor and hoist. With more water in the river, and more power, both of these mines on the Merced River will, no doubt, increase their output to a considerable extent.

The Ruth Pierce mine near Hornitos has been operating a ten-stamp mill one shift per day for the last year and a half. Approximately 400 tons of ore per month is milled, which will average $9 per ton.

The Virginia mine, near Coulterville, has been a continuous producer for many years. This is a ten-stamp mill and the ore averages around $18 per ton. Three shifts operate the mill continuously.

In the latter part of 1919 there were several properties in Mariposa County which were being reopened, and no doubt some of these will be producers in 1920. The old Sweetwater mine near Jerseydale had been thoroughly sampled, and the ten-stamp mill was being overhauled, preparatory to beginning operation. The Silver mine near Mariposa, after much difficulty due to war conditions and water shortage, will probably be on a producing basis early in 1920. At the Carrie Todd mine near Kinsley it is planned to erect a ten-stamp mill in the near future. The old Quail mine, eight miles west of Coulterville, promises future production. The Number Nine mine, east of Hornitos, is in litigation over ownership. If this can be settled, the mine will immediately begin operating.

There are many properties in Mariposa County which appear worthy of further development or at least investigation, but capital does not appear anxious to invest in this district. There are several instances of poor management, where thousands of dollars have been spent on top of the ground, in mills and machinery, before the quality or extent of the orebody was determined, and these failures, combined with the facts that a great deal of territory (44,000 acres) are tied up in the 'Mariposa Grant' and the district is at the 'end of the Mother Lode,' have discouraged capital. Abandoned and idle properties are in the great majority. There are over two hundred more or less developed mines in the county, not counting mere prospects, and of these only four were operating on a producing basis in October, 1919.

In the White River district in Tulare and Kern counties, the Blue Mountain quartz mine was being reopened in November, 1919, by a company of which J. W. Howard was president and Rodney McCormick secretary. This mine promises production for 1920.

Chrome and Manganese.

During the war chrome and manganese were extensively produced, principally in the Livermore district in Alameda, Santa Clara, San Joaquin and Stanislaus counties, and in Mendocino, Sonoma, Glenn, Lake, Napa, Fresno and Tulare counties. Since the close of the war and the consequent break in the market there has been practically no activity in mining these minerals, only a few tons of high grade ore being produced.

Cement.

The district produces most of the cement manufactured in the state. Large plants are located at Davenport, Santa Cruz County; Cement, Solano County; Cowell, Contra Costa County; Napa Junction, Napa County, and a smaller plant at San Juan, in San Benito County. The production of these plants decreased in 1918 but the value of product increased. In a general way, the several plants maintain quite steady production, the demand for cement being regulated by the amount of concrete construction work. Some of the plants have not been working to capacity and it is difficult to state whether the production for 1919 will be greater or less than for 1918. It is quite safe to say, however, that the production figures will not be greatly changed. The prospect for 1920 is for an increase in production, due principally to increase in highway construction.

Stone.

Miscellaneous stone, including crushed rock, sand, gravel, paving blocks, etc., is produced in all but three counties in the district. The largest producing counties are Contra Costa, Alameda, Sacramento, Fresno, Sonoma and Tulare. The production is governed by demand in concrete buildings, highway construction, railway ballast, etc., and does not change materially from year to year.

Brick and Tile.

In the manufacture of brick and tile, San Joaquin, Alameda and Contra Costa counties are the largest producers in the district, followed by Sacramento, Fresno and Santa Clara counties. At all such plants, production in 1919 was maintained at about normal.

Salt.

Alameda County leads the state in salt production, followed by San Mateo. The production comes from many plants located on the tide lands of San Francisco Bay. These plants maintained production during 1919 at about normal.

Zinc.

The Butters electrolytic zinc refinery, located about two miles east of Martinez, Contra Costa County, began operating about the middle of the year 1919. Ore from the Afterthought mine in Shasta County is treated by leaching and electrolytic precipitation. The process is said to be highly successful and considerable custom ore, from various parts of the state, is also treated. The plant has a capacity of about three tons of metallic zinc per day.

Copper.

The Mountain Copper Company have for the last fourteen years operated a large copper smelter located on the south shore of Suisun Bay, about one mile northeast of Martinez. There is also a sulphuric acid plant and a fertilizer plant in connection with the smelter.

The plant was closed for several months in 1919, due principally to an over-supplied copper market.

When operating, it has a capacity of from 300 to 350 tons of crude ore daily, and employs between 150 to 200 men.

3. Labor Situation.

Labor in many branches of the mining industry has been scarce, and the quality is, in general, below the standard of a few years ago. This is entirely to be expected from the higher wages paid in other industries, and the inability of producers, especially the gold producers, to meet these high wages. The larger magnesite companies have been fortunate in keeping their entire crews. At the Tulare Magnesite Company's works at Porterville, many of the men, mostly Italian, have been with the company for from ten to fifteen years. A bonus is given the men for each additional year's service. The labor shortage has probably not been felt so much in this district as in the larger metal mining districts of the state.

At the Mountain King mine, Mariposa County, the following wages were paid in 1919: Foreman, $175 per month; shift bosses $5 per day; miners $4 to $5; timbermen $4; shovelers $3.75; trammers $3.75; hoistmen $4; blacksmiths $5; timber-framers $4.50; millmen $4; general surface $3.50.

4. Generally Recognized Needs of the Industry.

Probably the greatest difficulty met with during the last few months has been the shortage of railway cars for shipping. This shortage has been especially felt at the magnesite properties, rock crushing plants and cement plants. This difficulty was to be expected during the war, but there appears to be no excuse for such a condition at the present time.

Good roads for transportation by motor trucks are abundant, except in the more isolated parts of the district.

Tariff protection on imports would greatly aid the magnesite, chrome and manganese producers.

LOS ANGELES FIELD DIVISION.

1. Variety of Minerals Produced.

Antimony, asbestos, barytes, bituminous rock, borax, clay, cement, copper, chromite, diatomaceous earth, dolomite, feldspar, fullers earth, gems, gold, graphite, granite, gypsum, iron, lead, limestone, lithia, magnesite, manganese, marble, mineral paint, mineral water, molybdenum, natural gas, petroleum, potash, pumice, quicksilver, salt, silver, silica, soda, stone, strontium, tungsten, zinc.

Of the above minerals that have been mined in the district, only the properties producing at present will be outlined in the following summary under the heads of minerals and the counties wherein produced.

MINES AND PLANTS.

BORAX.

Sterling Borax Company, plant at Lang, Los Angeles County.

Pacific Coast Borax Company, operating mines and calcining plant at Death Valley Junction, Inyo County. Producing 50 tons of first class ore, and about 200 tons of second class ore. The first class ore is shipped direct to refineries at Alameda, California, or to Bayonne, New Jersey. All second class ore treated in plant at Death Valley Junction.

Pacific Coast Borax Company are reopening the Neel Borate mine near Daggett, San Bernardino County, and are shipping some ore to the refineries of the company.

Union Borax Company, with offices at 328 I. W. Hellman Building, Los Angeles, are developing a borate deposit on the claims owned by the company which adjoins the Neel Borate mine.

CLAY AND CLAY PRODUCTS.

Imperial County.

Simonds Brick Company, Los Angeles, operates a brick yard at El Centro; producing hollow tile, and common red brick. Capacity of plant, 50,000 bricks daily.

Kern County.

Bakersfield Sandstone Brick Company, plant at Bakersfield. Daily capacity, 40,000 bricks.

Kern County Brick Company, plant at Bakersfield. Capacity 37,000 bricks.

Los Angeles County.

J. A. Bauer Pottery Company, Los Angeles city, manufacturing flower pots, stoneware, vases, etc.

Furlong-Paxon Pottery Company, Los Angeles city, manufacturing white ware.

K. & K. Brick Company, Los Angeles city, manufacturing common brick. Capacity 74,000 bricks per day.

K. & M. Pottery, Los Angeles city, manufacturing stoneware.

Long Beach Brick Company, plant at Long Beach, manufacturing common red brick.

Los Angeles Brick Company, Los Angeles city. Company has three plants under operation with a capacity of 130,000 bricks per day.

Los Angeles Pressed Brick Company, Los Angeles city. This company is the largest manufacturer of clay products in the west, operating two plants in Los Angeles County.

Pacific Minerals and Chemical Company, of West Glendale; manufactures sewer pipe. The company is also grinding talc from its mine in San Bernardino County, shipping about a carload a day to eastern consumers.

Pomona Brick Company, of Pomona, manufactures common red brick. Daily capacity of plant 25,000 bricks.

St. Louis Firebrick and Clay Company, Los Angeles city. Company manufactures fire brick. Daily capacity of plant is 65,000 bricks.

Simonds Brick Company, Los Angeles. This company operates three brick yards in Los Angeles County, manufacturing common brick, red pressed tile, ruffle brick, hollow building tile and roofing tile.

Southern California Clay Products Company, Vernon. This company manufactures exclusively chemical stoneware, obtaining the clays from San Bernardino and San Diego counties.

Standard Brick Company, Los Angeles. This company operates two yards for the manufacture of common red brick. Daily capacity 40,000 bricks.

Standard Pottery Company, Los Angeles, manufactures flower pots, ollas, and china ware.

West Coast Tile Company. Purchased by the American Encaustic Tile Company, of New York. The company manufactures wall tile, trim tile, floor tile and faience tile.

Orange County.

La Bolsa Tile Company, plant at Smeltzer. The company manufactures drain tile.

Santa Ana Brick Works, Santa Ana, California. This company manufactures common brick. Capacity 40,000 bricks daily.

Riverside County.

Alberhill Coal and Clay Company, Alberhill, California. This company is the largest producer of clay in southern California, shipping a large tonnage of clay to the different clay manufacturers of Los Angeles city. Total amount of clay mined during 1918 was 70,000 tons.

Los Angeles Pressed Brick Company's plant No. 4 is located at Alberhill. It is at present consuming approximately 7000 tons of clay monthly in the manufacture of building tile and fire brick. All the clay is secured from the Alberhill Coal and Clay Company. Capacity of plant is 40,000 fire bricks per day and 200 tons of building tile.

Pacific Sewer Pipe Company. The company is manufacturing fire brick, sewer pipe and drain tile at its plant at Corona. The clay is secured from deposits owned by the company near Alberhill and Corona.

San Bernardino County.

The Southern California Clay Products Company, Los Angeles, are shipping clay from a deposit at Newberry, for the manufacture of chemical stoneware.

San Diego County.

Southern California Clay Products Company are mining and shipping clay from a deposit located east of Encinitas. The clay is used at the Los Angeles plant in the manufacture of fire bricks and crucibles.

American Encaustic Tile Company are mining and shipping to their plant at Los Angeles, a feldspathic rock, named duroc, from the vicinity of Dehesa, which is utilized for making tile.

Sunnyside Brick Company of San Diego is manufacturing building tile.

Union Brick and Tile Company of San Diego is manufacturing red brick at their plant in Rose Cañon.

Outlook for 1920.

Owing to the increase in building operations during the latter part of 1919, the prospects are bright for an increased production of clay products. The manufacturers, therefore, are looking forward to large demand for their products during 1920.

COPPER.

Due to the drop in the price of copper after the signing of the armistice on November 11, 1918, all developing and mining of copper ores was suspended.

The prospects look favorable for a revival of mining of copper ores, especially those containing silver values, for the coming year, as after the peace treaty has been ratified, there is every possibility of a large

demand for export to foreign countries, where the stock of metal is low. The renewal of building operations in the United States will also increase the demand for copper.

CHROMITE.

San Luis Obispo and Santa Barbara counties were large producers of chromite during 1918. Chrome mining in these counties has nearly ceased, and from January 1 to July 1, 1919, only two properties were under operation in San Luis Obispo. These two properties have recently suspended operations. Owing to the lack of demand and to the low prices offered for chromite, the outlook is not very favorable for any activity in this field.

DIATOMACEOUS EARTH.

The deposits of diatomaceous earth in the vicinity of Lompoc, Santa Barbara County, are said to be the purest and most extensive found in the state. The Celite Products Company are operating their property on an extensive scale, and are shipping a large tonnage to eastern points.

DOLOMITE.

Dolomite is being quarried from the deposits near Keeler, Inyo County, and shipped to the Soda Products Company's plant on Owens Lake.

FELDSPAR.

The American Encaustic Tile Company of Los Angeles are mining and shipping feldspar from a deposit located near Lakeview, Riverside County.

The material is used for glazing purposes at the company's plant in Los Angeles.

A number of deposits in the same district were worked during 1918 for the potash content, the material being used by the Riverside Cement Company.

Most of these deposits have been either worked out, or have suspended operations.

FULLERS EARTH.

A large tonnage of what is known as "Death Valley clay" is being mined from a deposit near Death Valley Junction, Inyo County, by the Standard Oil Company, and shipped to the refinery at El Segundo, California.

Rainbow Mining and Mineral Products Company, of Elsinore, Riverside County, are constructing a grinding mill for treatment of Fuller's earth. The deposit is located three miles north of Elsinore.

GEMS.

There was no activity in the mining of gems at Pala, San Diego County, during 1918 and 1919.

GOLD.

There is little stimulus for an increased production of gold, the added cost of materials and labor forcing many properties to suspend operations.

Gold production for 1919 shows a decrease from 1918 in Inyo, Kern and San Bernardino counties.

The prospects do not appear to be at all favorable for any activity in gold mining for 1920.

The following mines were under operation in 1918 and 1919:

Kern County.

Black Hawk gold mine, Johannesburg. D. A. Blue, owner.

Keyes mine, Isabella. Keyes Mining Company of San Diego. Five stamp mill.

Shipsey mine, Johannesburg. Owned by Shipsey Mining Company of Los Angeles. Operated by leasers. Five stamp mill.

Minnehaha mine, Johannesburg. Owned by E. B. Maguines of Randsburg. Operated by leasers.

Trio mine, Mojave District, has been reopened by Trio Mining Company of Los Angeles. Active development campaign planned by the company. Twenty stamp mill on property.

Yellow Aster mine, Randsburg. Operated by Yellow Aster Mining Company of Los Angeles. Property being operated on a small scale, selective mining of ore. Ten stamps of the 100-stamp mill crushing ore.

Zenda mine, in Amalie Mining District, is to be reopened by Zenda Mining Company.

Inyo County.

Wilshire Bishop Creek mine, Bishop, ten stamp mill and flotation plant.

San Bernardino County.

Gold Mountain mine, Bear Valley District, was purchased and reopened by James Hulme of Berkeley, California, in October, 1918, and has been under continuous operation since that date. Thirty stamps are crushing ore. On account of shortage of labor, operations will be suspended on December 1st, but it is planned to resume operations in the spring.

Brooklyn Mine, Virginia Dale District, owned by Brooklyn Mining Company of Highland, California. The company is doing some

development work on the property. Plant consists of a Nissen stamp mill and cyanide plant.

Twenty-Nine Palms District. The Gold Park Mining Company are doing some development work on the Black Warrier and other claims.

San Diego County.

The North Hubbard mine, Julian District, has been reopened, and a five stamp mill has been installed. J. W. Lyons of Julian, superintendent. Owners are Frank Talbott and Brohenshine of San Diego.

GRAPHITE.

California Graphite Company of Los Angeles are operating their graphite deposit in San Francisquito Cañon, eighteen miles from Saugus.

A new concentration plant has been installed, and recently placed in operation. The company is supplying the local market with material for foundry facings.

GYPSUM.

Riverside County.

The United States Gypsum Company are developing and operating a deposit northwest of Blythe, California.

San Bernardino County.

Consolidated Pacific Cement Plaster Company of Los Angeles. This company is working the Amboy Dry Lake deposit two miles southwest of Amboy. Capacity of calcine plant is 100 tons per day.

LIME.

Summit Lime Company, offices Los Angeles, California, are operating two plants at Tehachapi, Kern County, California.

LIMESTONE—CEMENT.

Riverside County.

The cement plant of the Riverside Portland Cement Company was under steady operation during the year.

San Bernardino County.

Baxter lime quarry, at Baxter Station on the Salt Lake Railroad, was under lease to the Sugar Lime Rock Company, 522 Pacific Electric Building, Los Angeles, California, and a certain tonnage of lime rock was shipped to sugar beet factories during the year. The quarry was not operated steadily.

California Portland Cement Company, offices 401 American Bank Building. The company's plant at Colton was under steady operation during the year.

The Southwestern Portland Cement Company's plant at Oro Grande was a steady producer.

MAGNESITE.

No magnesite was produced from the Bissell deposit during 1919. Owner, International Magnesite Company, Pasadena, California.

International Magnesite Company's plant at Chula Vista, San Diego County, recently resumed operations. Treating ore from San Margarita Island, Mexico.

MANGANESE.

The Black Jack Manganese mine and Bray Manganese mine, situated in the McCoy Mountains, twelve miles from Mineral Station, northwest of Blythe, Riverside County, were under operation until July, 1919, when operations were suspended on account of low prices for manganese ores.

Some manganese ore was shipped in 1919 from a deposit near Palmdale, owned by the Llewellyn Iron Works. The ore was used in the company's plant at Terrance, California.

POTASH.

The American Trona Corporation's plant at Trona on Searles Lake was completed during the year, and was under steady operation most of the time, being a large producer of potash salts.

Another plant on Searles Lake was operated by the Boro-Solvay Company.

Outlook for Potash Industry.

The Potash Salts Bill, providing for licensing control of imports of potash salts in the interests of potash salts producers, will, if passed by Congress, be a help to the California producers of potash.

If the German and Alsatian supplies of potash are allowed to come in free of duty, it will be a means of killing the potash industry of the state.

There is also a large possibility that Europe will need all the potash that Germany and Alsace can supply for the next two years. This will give a chance for the American concerns to establish themselves on a producing basis to supply this country's needs, and help enable them to cut their costs of production so as to compete with the foreign producers of potash salts.

PUMICE.

The only production of pumice was made by Brand and Stevens of Los Angeles from a deposit near Calipatria, Imperial County.

QUICKSILVER.

The Cuddeback quicksilver mine, near Tehachapi, Kern County, was a producer during 1919. The ore being treated in a 12-pipe retort.

Property is operated by leasers.

LEAD, SILVER AND ZINC.

Inyo County.

Cerro Gordo mine, the largest producer of lead-zinc ores in the state, suspended operations during the early part of 1919, on account of the low prices for lead and zinc, and increased cost of labor and material.

The Darwin Development Company are doing some development work on the Lane and Lucky Jim mines in the Darwin Mining District; 50-ton concentration plant.

The Tecopa Consolidated Mining Company have resumed operations on the Gunsite, Noonday and Grant mines in the Tecopa District; 100-ton concentration plant on the Gunsite mine.

San Bernardino County.

Bonanza King mine, situated in the Trojan Mining District was purchased by Hall, Rowster & Company, Acton, Massachusetts. Active underground development operations are being prosecuted under the supervision of Roscoe Miller, superintendent. Reported that approximately 15,000 tons of milling ore have been developed. Allis-Chalmers ball mill and floatation plant has been installed for treatment of ore. K. & K. flotation machines are to be used. Fifty men are employed.

The Avawatz Crown mine, Silver Lake District, has been reopened by Alvin B. Carpenter and associates of Los Angeles. Shaft has been sunk to a depth of 325 feet, and crosscut driven on 300-foot level, and the brecciated quartzite zone was cut for a distance of 200 feet. This entire zone was found to be mineralized with silver bearing galena, averaging 4 ounces silver and 9 per cent lead. Hoisting machinery and compressor are being installed on the property, and an intensive development campaign is planned.

Calico Mining District. Due to the high price of silver, prospecting is active in this old silver camp. Lane and associates are shipping ore from the district.

In the Rand Mining District near Randsburg, the Rand Divide mine was opened up by John W. Kelly and associates of Bakersfield. Rich silver ore was discovered on the surface and a shaft was put down on the discovery, which developed high grade ore, 15 feet in width. Approximately $150,000 worth of ore has been shipped from the property. The average of shipments made ran about 50 ounces silver with gold values.

The ore occurs in a brecciated quartzite.

Outlook for the Future.

Due to the high price of silver the prospects are very bright for increased activity in the mining of silver ores.

The possibilities appear bright for the revival of some of the old silver camps in this district, which have been large producers in the past.

SILICA.

Riverside County.

A number of silica deposits are being worked in the vicinity of Lakeview. The principal shipper is the American Encaustic Tile Company, who have opened a large deposit near Nuevo, and are shipping a large tonnage to the company's plant in Los Angeles.

The Rainbow Mining and Mineral Products Company of Elsinore, California, are developing a deposit near Murrietta.

SODA.

Inyo County.

Several plants are in active operation on Owens Lake in the production of soda.

The California Alkali Company, at Cartago, is operating its 100-ton plant to capacity. One hundred men are employed.

Natural Soda Products Company, near Keeler, are producing about 30 tons of soda per day.

San Luis Obispo County.

Consolidated Chemical Company, Soda Lake, Carrizo Plain, was a producer of sodium sulphates during 1918, but owing to litigation the property has been idle during 1919. During 1918 shipments were made to the Torrance Glass Works, at Torrance, California.

STONE INDUSTRY.

Due to the outlook for a revival of building operations during the coming year, there should be an increased production of crushed rock. A number of plants are in operation in the vicinity of Los Angeles, the principal producer being the Pacific Rock and Gravel Company, who have two plants under operation near Azusa, California.

Riverside County.

The Temescal Rock Company operated the Temescal quarry four miles southeast of Corona, on a small scale during 1919.

TALC.

The largest producer of talc during the year was the Acme Talc mine, located seven miles east of Acme station on the Tonopah and Tidewater Railroad. Forty tons of material is being mined and shipped

per day to the Pacific Minerals and Chemical Company's plant at West Glendale, California.

The Amos Brothers of San Bernardino are large shippers of talc from a deposit located in the Silver Lake Mining District.

San Diego.

Otaylite Products Company, Los Angeles, have purchased a deposit of talc situated six miles southeast of San Diego on the Jamul ranch, near Otay.

The company is planning to develop the deposit, and put in a grinding plant. M. A. Hamburger, president, and E. H. McCullough, secretary, of Los Angeles, are the officers of the company.

TUNGSTEN.

The tungsten mines of Inyo and San Bernardino counties suspended operations during the latter part of 1918, due to drop in prices and small demand for tungsten.

The bill before Congress to put a duty on imports of tungsten concentrates should be of some help to the producers.

Labor Situation.

Due to the scarcity and high prices of labor the mining operators are working their properties with difficulty, and the present outlook is not encouraging for an abundant supply of labor.

Tariff Protection.

With a tariff placed on imports of magnesite, potash, quicksilver and tungsten great assistance would be rendered to the producers of these materials.

PETROLEUM.

The dependence of the industries of the Pacific slope upon California petroleum lends importance to a survey of the conditions affecting the oil business.

The total oil production in California during the year 1919 amounted to about 100,000,000 barrels, according to preliminary estimates by R. P. McLaughlin of the California State Mining Bureau. The final figure will probably show that the year's output was slightly more than that of the year 1918.

The total value of crude oil at the wells was about $133,000,000, which is some five or six millions greater than the total value of the preceding year.

The field price of crude California oil has advanced during the last six years in almost exact accordance with the price of farm products, with the exception that in 1914 and 1915 oil was relatively cheaper.

Farm products during those two years advanced slightly, while oil suffered a marked decline.

The price of California fuel oil, at tidewater, has advanced less, proportionately, than has the field price of crude oil. The present margin between the field price of 24° Baume crude and that of fuel oil, at tidewater, is 25 cents, the same as during 1916. The price of California oil may not, therefore, be reasonably expected to decline until the general price level of all commodities falls.

On the other hand, it should be noted that oil is still cheaper than coal, which sells for about $8 per ton on Puget Sound, as against $6.47 for an equivalent amount of oil (3½ barrels) at the same point of delivery. Further advance in the price of oil might, therefore, appear reasonable.

The increase or decrease of the amount of oil in storage has for several years been generally considered an index for field prices. During the past year and a half, however, the effect of stored oil on field prices has been entirely obliterated or neutralized by the general condition of advancing prices of all commodities.

Current statistics by private concerns disagree as to the actual amount of oil now stored, but do agree in indicating that stocks were somewhat less at the end of the year 1919 than at the beginning. Such a condition, in conjunction with the fact that total production was approximately the same as during the previous year, shows that the industry has not quite held its own.

The effort to maintain the status referred to involved the addition of some 500 new producing wells, in order to offset the natural decline of productiveness of old wells. The daily rate of production per well declined during the year from 32 barrels to 30½ barrels. The rate of decline has been fairly constant since 1916, when the average well was producing 37 barrels of oil per day.

The acreage of proved oil land was materially increased during the year 1919 by developments in the Elk Hills, in Kern County, and in the Richfield field, in Orange County. The total proved oil land is now probably more than 91,000 acres, as compared with 89,212 acres in March, 1919.

The development of a very great supply of gas in the Elk Hills will doubtless greatly benefit neighboring cities in the San Joaquin Valley. This development was the direct outcome of recommendations based on engineering investigation by the State Mining Bureau.

The Elk Hills region constitutes a major portion of Naval Petroleum Reserve Number One, which has long been the subject of discussion before Congress and of litigation in the federal courts. A recent decision of the Supreme Court cancelled patents of the Southern Pacific

Company to some 6000 acres of land, having a value of probably eight or ten million dollars. That the United States Navy should have a large and certain supply of oil on the Pacific Coast can not be doubted. Two reserves of oil land have been established, but the government does not hold clear title to much of the land. Recent developments in Reserve Number One demonstrates its value as an oil producer, and it probably also contains a large amount of land, title to which may be determined to have never passed from the government. The total area of the reserve is about 37,600 acres, about 25,700 acres being unpatented and subject to future determination of title. The recent court decision, covering about 6000 acres, apparently definitely returns title to the government. Patented lands in the reserve amount to about 5900 acres, of which the Southern Pacific Company holds about 4600 acres.

The greatest event of the year, in determining title to oil land, was the decision of the United States District Court in the consolidated cases of the government against the Southern Pacific Company, involving 161,267 acres, of which about 18,000 acres may be classed as proved oil land, having a value of possibly $36,000,000. The decision was in favor of the company, and press reports quote the Attorney General as saying that no appeal will be taken. Suit was commenced in December, 1912.

An important effect of the termination of the Southern Pacific suit would seem to be an increased supply of oil to meet the varied demands of industry. Development of the railroad land, during the time of litigation, was retarded to such an extent that the railroad company annually purchased some four or five million barrels of oil from other producers. The probable productivity of the land seems to indicate that the present number of productive wells can be at least trebled.

Construction of additional hydroelectric power plants is reported as going forward to such an extent that the present annual consumption of oil, for generating electricity, will be reduced by about 2,000,000 barrels. The present consumption of oil, for various industrial purposes, can be still further reduced by utilizing many well known sources of water power.

Proposed federal legislation providing for the leasing of government owned oil lands has progressed far enough to show about what lines it will pursue. The final enactment of such legislation would indicate that development would proceed on a considerable area of proved oil land, resulting in increased oil production. Such an effect will probably not be instantaneous, as there are doubtless some claimants to land who will prefer to proceed with legal actions under the belief that they can obtain clear title to land rather than a lease. Most of the proved

oil land affected by proposed legislation is probably covered by the claims which will be given preference in the issuance of leases. The existence of such preferred claims is a factor of importance to many oil operators outside of California, who have anticipated commencing operations here as soon as governmental leasing becomes effective.

Waste of oil, and damage to the natural deposits through improper production methods, has decreased under state supervision. The details of state supervision have been so developed and systematized that the regularly published monthly reports of the State Oil and Gas Supervisor briefly and clearly show the relative efficiency of all important producers.

The burning of crude oil, without first extracting its more valuable constituents by refining, is an economic waste which is apparently being eliminated. During the past year about 80 per cent of the total oil production passed through refineries, as against only 60 per cent two years earlier. The average yield of refined products from a barrel of oil was about 5 gallons of gasoline, 2½ gallons of kerosene, ¾ gallon of lubricants, 4 pounds asphaltum, and 28 gallons of fuel oil.

Stocks of refined products, as reported by the United States Bureau of Mines, during the first nine months of the year, showed considerable variation. Gasoline stock was the only one to decline, the September figure being 20,183,511 gallons as compared with 35,579,288 gallons in January; kerosene increased from 13,085,166 gallons to 21,549,590 gallons; lubricants increased from 8,630,730 gallons to 14,175,482 gallons, and asphalt increased from 8847 tons to 10,542 tons.

Consideration of the foregoing facts indicates an encouraging outlook for the coming year. Production from proved lands should continue with profit to producers as well as the industries dependent upon oil. It is almost an assured fact that all the oil deposits of the state have not yet been discovered, and further prospecting under the guidance of thoroughly qualified geologists should be profitable.

ESTIMATED CALIFORNIA MINERAL PRODUCTION IN 1919.

By WALTER W. BRADLEY, *Statistician and Curator.*

The statistical division of the State Mining Bureau estimates the mineral production of California for the year 1919 at a total value of approximately $182,463,000. This is a conservative figure, and includes all products, metallic and nonmetallic, being in advance of the actual figures which will be available later when the complete returns are received from the various producers. This is a decrease of approximately $17,000,000 compared with the 1918 total, and is due to the marked drop in prices and the cessation in demand of the so-called "war minerals."

Individually, increases were made by petroleum and gold. The former, while increasing but slightly in total number of barrels, showed an increase of about $6,000,000 in value. Gold increased approximately $800,000 in value, indicating that this form of mining in California is already beginning to readjust itself. However, this recovery from the downward trend of the preceding three years and particularly from the abnormal drop in the 1918 output, is the result of improved grades of ore in some of the larger lode mines, rather than from the reopening of old properties.

Notable decreases in value are shown by: copper, approximately $7,600,000; potash, $6,000,000; tungsten, $2,770,000; quicksilver, $1,200,000; and by chromite, lead, manganese, and zinc. Dropping from the record figures attained in the period 1916–1918, the production of chromite, potash, and of tungsten became practically nil in 1919. Shipments of manganese ores amounted to only about 50 per cent of the 1918 output.

The date of publication of the final and complete report on the mineral production for the year is dependent upon the promptness of the replies from the operators. The law requires that reports must be made to the State Mining Bureau, the details of the individual returns being held confidential.

The estimated quantities and values for 1919 are tabulated as follows:

	Quantity	Value
Gold		$17,320,000
Silver	1,121,000 ounces	1,244,000
Tungsten concentrates	100 tons	60,000
Copper	22,300,000 pounds	4,237,000
Lead	4,450,000 pounds	254,000
Zinc	970,000 pounds	69,000
Quicksilver	15,000 flasks	1,300,000
Platinum	500 ounces	60,000
Petroleum	100 000,000 barrels	133,000,000
Chromite	1,500 tons	39,000
Manganese	11,000 tons	220,000
Magnesite	60,000 tons	480,000
Natural gas	47,000,000 M. c. ft.	3,500,000
Brick, cement, building stone, crushed rock, etc.		13,550,000
Miscellaneous "industrial" minerals		2,000,000
Salines (including borax, potash, salt, soda)		5,130,000
Total		$182,463,000

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